information systems

Volume Contents and Author Index
Volume 11, 1986

PERGAMON PRESS
OXFORD NEW YORK BEIJING FRANKFURT
SÃO PAULO SYDNEY TOKYO TORONTO

Information Systems

Editors

Editor-in-Chief

Hans-Jochen Schneider
Institut für Angewandte
Informatik
Technische Universität Berlin, FR 5-8
Franklinstrasse 28/29
D-1000 Berlin 10/Fed. Rep. Germany

Assistant to the Editor-in-Chief

Gert Scheuernstuhl
Haessler Software GmbH
Einsteinstrasse 18
D-7505 Ettlingen/Fed. Rep. Germany

Regional Editors

Yu. Drobyshev
Computer Center
Novosibirsk 630090/USSR

G. M. Nijssen
University of Queensland
Department of Computer Science
St. Lucia (Brisbane)
4067 Queensland/Australia

Gerard Salton
Department of Computer Science
Cornell University
Ithaca, NY 14853/U.S.A.

Editorial Advisory Board

Phillip A. Bernstein
Department of Information Technology
Wang Institute of Graduate Studies
Tyng Road
Tyngsboro, MA 01879/U.S.A.

Horst Biller
SIEMENS AG
D ST DB 1
Otto-Hahn-Ring 6
D-8000 München 83/Fed. Rep. Germany

Giampio Bracchi
Politecnico di Milano
Dipartimenti di Elettronica
32, Piazza Leonardo da Vinci
1-20133 Milano/Italy

Michael Brodie
Computer Corporation of America
Four Cambridge Center
Cambridge, MA 02142/U.S.A.

Janis Bubenko, Jr
Department of Information Processing
and Computer Science
University of Stockholm
S-10691 Stockholm/Sweden

Alfonso F. Cardenas
Computer Science Department
University of California
Boelter Hall, 3731
Los Angeles, CA 90024/U.S.A.

Hsu Cho Chun
Computer Science Department
Peking University
Beijing
People's Republic of China

E. F. Codd
Relational Institute
6489 Camden Avenue
Suite 106
San Jose, CA 95120/U.S.A.

Miroslaw Dubrawski
Institute for Scientific, Technical and
Economic Information
Zurawia 3/5 Street
PL-00-926 Warsaw/Poland

James C. Emery
University of Pennsylvania
The Wharton School
Dietrich Hall CC, 3620 Locust Walk
Philadelphia, PA 19104/U.S.A.

Gordon C. Everest
Management and Economics Building
School of Management
University of Minnesota
Minneapolis, MN 55455/U.S.A.

Eckhard Falkenberg
University of Queensland
Department of Computer Science
St Lucia (Brisbane)
4067 Queensland/Australia

Joyce Friedman
Department of Computer and
Communication Sciences
University of Boston
Boston, MA 02125/U.S.A.

Virgil D. Gligor
Electrical Engineering Department
University of Maryland
College Park, MD 20742/U.S.A.

Robert V. Kalter
LOGICON
Operating Systems Division
6300 Varial Avenue
Woodland Hills, CA 91364/U.S.A.

Isamu Kobayashi
SANNO Institute of Business
Administration
1573 Kamikasuya, Isehara
Kanagawa 259-11/Japan

Ernard Konrad
Technische Universität Berlin
Fachbereich Informatik, FR 5-8
Franklinstr. 28/29
D-1000 Berlin 10/Fed. Rep. Germany

Gert v. Kortzfleisch
Industrieseminar der
Universität Mannheim
Schloss
D-6800 Mannheim/Fed. Rep. Germany

Toshyasu Kunii
Department of Information Science
University of Tokyo
Hongo, Tokyo 113/Japan

Witold Litwin
Institut National de Recherche
en Informatique et en Automatique
Domaine de Volucea-Rocquencourt
B.P. 105
F-78153 Le Chesnay Cédex/France

Henry C. Lefkovits
AOG Systems Corporation
Harvard Depot Road
P.O. Box M
Harvard, MA 01451/U.S.A.

Fred Lochovsky
Computer Systems Research Group
University of Toronto
Toronto, Ontario/Canada M5S 1A1

Peter Lockemann
Institut für Informatik II
Universität Karlsruhe
Zirkel 2/Postfach 6380
D-7500 Karlsruhe 1/Fed. Rep. Germany

Nan K. Loh
Center for Robotics and
Advanced Automation
Oakland University
Rochester, MI 48063/U.S.A.

Frank A. Mancia
Computer Corporation of America
Four Cambridge Center
Cambridge, MA 02142/U.S.A.

Jack Minker
Computer Science Department
University of Maryland
College Park, MD 20742/U.S.A.

Rudolf Munz
NIXDORF Microprocessor
Engineering GmbH
Berliner Str. 66
D-1000 Berlin 27/Fed. Rep. Germany

Thomas H. Naylor
Department of Economics
Duke University
Durham, NC 27706/U.S.A.

Erich J. Neuhold
Institut f. Angewandte Informatik
TU Wien
Panigel Gasse 16
A-1040 Wien/Rep. Austria

Garth M. Notley
Microprocessor Consultancy Services Ltd
Sparrow Grove, Shawford
Hampshire SO21 2BY/England

Michael L. O'Connell
Digital Equipment Corporation
2 Iron Way
MR03-1/G18
Marlboro, MA 01752/U.S.A.

T. William Olle
2 Ashley Park Road
Walton-on-Thames
Surrey KT12 1JU/England

Alain Pirotte
Philips MBLE
2 Avenue van Becelaire
B-1170 Brussels/Belgium

Allen Reiter
Reiter Software Systems Ltd
23rd Floor, Haifa University
P.O. Box 7260
Haifa 31092/Israel

Gernot Richter
Gesellschaft für Mathematik und
Datenverarbeitung mbH Bonn
Postfach 1240
D-5205 St Augustin1/Fed. Rep. Germany

C. J. van Rijsbergen
Department of Computer Science
University College Dublin
Belfield
Dublin 4/Eire

Naomi Sager
Courant Institute of Mathematical Sciences
New York University
251 Mercer Street
New York, NY 10012/U.S.A.

Erik Sandewall
Department of Computer and Information
Science
Linköping University
S-58183 Linköping/Sweden

Roger C. Schank
Department of Computer Science
Yale University
New Haven, Connecticut 06520
U.S.A.

Gunter Schlageter
FernUniversität Hagen
Praktische Informatik
Postfach 940
D-5800 Hagen
Fed. Rep. Germany

Joachim W. Schmidt
Johann-Wolfgang Goethe-Universität
Fachbereich Informatik
Postfach 11 19 32, Dantestr. 9
D-6000 Frankfurt am Main 11
Fed. Rep. Germany

W. Schönfeld
IBM Deutschland GmbH
Wiss. Zentrum Heidelberg
Tiergartenstraße 15
D-6900 Heidelberg
Fed. Rep. Germany

Heinz Schweppe
Freie Universität Berlin
Fachbereich Mathematik
Institut für praktische Informatik
Arnimallee 6–8
D-1000 Berlin 33
Fed. Rep. Germany

Dennis G. Severance
University of Michigan
Graduate School of Business Administration
904 Monroe
Ann Arbor, MI 48109/U.S.A.

Edgar H. Sibley
3000 Miller Heights Road
Oakton, VA 22124/U.S.A.

Kenneth F. Siler
500 Castano Corte
Los Altos, CA 94022/U.S.A.

Robert Simmons
Department of Computer Science
University of Texas at Austin
Austin, Texas 78712/U.S.A.

Vladimir Slamecka
School of Information and Computer Science
Georgia Institute of Technology
Atlanta, GA 30332/U.S.A.

Arne Solvberg
Division of Computer Science
The Norwegian Institute of Technology
N-7034 Trondheim-NTH/Norway

T. B. Steel, Jr
AT&T
295 North Maple Avenue
Basking Ridge, NJ 07920/U.S.A.

Peter Stocker
University of East Anglia
School of Computing Studies and Accountancy
Norwich, Norfolk NR4 7PG/England

Gennady K. Stolyarov
Institute of Mathematics
Byelorussian Academy of Science
Surganov Str. 11
220604 Minsk 72/U.S.S.R.

A. A. Stogniy
Institute of Cybernetics
Academy of Sciences of the Ukrainian SSR
Academician Glushkov Prospect, 20
252207 Kiev-207/U.S.S.R.

W. Storz
FGAN
Forschungsinstitut f. Funk u. Mathematik
Königstraße 2
D-5307 Wachtberg-Werthhoven
Fed. Rep. Germany

Daniel Teichroew
Industrial and Operations Engineering Department
University of Michigan
Ann Arbor, MI 48104/U.S.A.

Dennis Tsichritzis
Centre Universitaire d'Informatique
Université de Geneve
24, rue General Dufour
CH-1211 Geneve 4/Switzerland

Alex A. Verrijn-Stuart
University of Leiden
Institute of Applied Mathematics and Computer Sciences
P.O. Box 9512
NL-2300 RA Leiden
The Netherlands

Anthony I. Wasserman
Medical Information Science
Room A-16
University of California
San Francisco, CA 94143/U.S.A.

Hartmut Wedekind
Inst. f. Mathem. Masch. u. Datenverarb. (VI)
Universität Erlangen-Nürnberg
Martensstr. 6
D-8520 Erlangen/Fed. Rep. Germany

Peter Wegner
Box 1910
Department of Computer Science
Brown University
Providence, RI 02912/U.S.A.

R. J. Welke
Faculty of Business
214-KTH
McMaster University
Hamilton, Ontario/Canada L8S 4M4

W. A. Woods
Applied Expert Systems, Inc.
5 Cambridge Center
Cambridge, MA 02142/U.S.A.

Zhiliang Xie
Department of Electrical Engineering and Computer Science
Shanghai Jiao Tong University
1954 Hua San Road
200030 Shanghai/P.R. of China

Lotfi Zadeh
Department of Electrical Engineering and Computer Sciences
University of California
Berkeley, CA 94720/U.S.A.

Alexander V. Zamulin
Computer Center
Novosibirsk 630090/U.S.S.R.

Consulting Editors

H. Borko
Graduate School of Library Service
University of California
405 Hilgard Avenue
Los Angeles, CA 90024/U.S.A.

Bernard Fry
Graduate Library School
Indiana University
Bloomington, IN 47401/U.S.A.

K. Samuelson
Information Processing ADP
Stockholm University
Fiskartorpsvägen 160 F
10405 Stockholm/Sweden

Publishing Office
Journals Production Unit, Pergamon Journals Ltd, Hennock Road, Marsh Barton, Exeter EX2 8NE, U.K. (*Tel.* Exeter (0392) 51558; *Telex* 42749).

Subscription and Advertising Offices
North America: Pergamon Journals Inc., Maxwell House, Fairview Park, Elmsford, NY 10523, U.S.A. *Rest of the World*: Pergamon Journals Ltd, Headington Hill Hall, Oxford OX3 0BW, U.K.

Subscription Rates
Annual institutional subscription rate (1987) DM 570.00; two-year institutional rate (1987/88) DM 1083.00; personal subscription rate for those whose library subscribes at the regular rate (1987) DM 143.00. Members of the IFIP may order personal subscriptions at a concessional rate. Details of these rates are available on request. Prices are subject to amendment without notice.

Microform Subscriptions and Back Issues
Back issues of all previously published volumes are available in the regular editions and on microfilm and microfiche. Current subscriptions are available on microfiche simultaneously with the paper edition and on microfilm on completion of the annual index at the end of the subscription year.

Published quarterly. Copyright © 1986 Pergamon Journals Ltd

It is a condition of publication that manuscripts submitted to this journal have not been published and will not be simultaneously submitted or published elsewhere. By submitting a manuscript, the authors agree that the copyright for their article is transferred to the publisher if and when the article is accepted for publication. However, assignment of copyright is not required from authors who work for organizations which do not permit such assignment. The copyright covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microform or any other reproductions of similar nature and translations. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, electrostatic, magnetic tape, mechanical, photocopying, recording or otherwise, without permission in writing from the copyright holder.

Photocopying information for users in the U.S.A.
The Item-Fee Code for this publication indicates that authorization to photocopy items for internal or personal use is granted by the copyright holder for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service provided the stated fee for copying, beyond that permitted by Section 107 or 108 of the United States Copyright Law, is paid. The appropriate remittance of $3.00 per copy per article is paid directly to the Copyright Clearance Center Inc., 27 Congress Street, Salem, MA 01970, U.S.A.

Permission for other use
The copyright owner's consent does not extend to copying for general distribution, for promotion, for creating new works or for resale. Specific written permission must be obtained from the publisher for such copying.

The Item-Fee Code for this publication is: 0306-4379/86 $3.00 + 0.00

INFORMATION ABOUT COMPUTER-ASSISTED INFORMATION SYSTEMS (CIS)

The number of CIS has so rapidly proliferated in recent years that it is difficult or even impossible for the individual to maintain an overview of the market (in a general sense) and to develop a feeling for where he should turn for what. This journal will make a survey of CIS that will on one side produce a compendium of systems, on the other side will provide the opportunity for an evaluation of the overall situation as well as of particular phenomena.

In this survey both standardized software packages that can be used to implement systems as well as individual systems with specific data base that is available for access will be included. Two different description forms will be used. The survey will first concentrate on software packages. We ask all authors or manufacturers of such software packages to hand in a system description in the format indicated below. This can be done by copying the category schema (including category number and name, e.g. "110 (acronym):", but leaving out the remarks on the right side), or writing to the Editor-in-Chief for a form. The schema is purposely kept small so that filling out the form will not impose a burden. The information supplied this way will be used to identify existing systems and to accumulate a basic stock of information that can be enhanced for special purposes.

General information

110 (acronym):	
120 (title):	full name of the system
130 (author/manufacturer):	
140 (person to contact for information)	full address and phone number
150 (reference, documentation):	literature, reports, system descriptions, etc.
170 (marketing information):	date of release, version, manufacturers support, rental or purchase costs
180 (short system description)	main feature, scope and purpose, application for which tailored

Required hardware

210 (manufacturer and model)	
220 (peripheral devices):	
250 (storage requirements):	various hierarchy levels

Required basis software

310 (operating system):	
320 (compiler):	if system is written in a language other than machine or assembler language

Data structure (user-level)

410 (user-accessible data units):	strings, items, records, relations, associations, files, etc.
420 (type of data structures):	networks, relational structures, hierarchies, mixed forms

Data structures (physical device level)

450 (storage stuctures):	
460 (access method(s):	
470 (restructuring possibilities):	

User languages

510 (data definition language):	
530 (query and updating language):	
550 (output format features):	
570 (application programs):	

Protection and security

610 (protection measures):	
650 (security measures):	e.g. possibility of user-introduced security codes

Performance

710 (response time):	
730 (multiple access):	
750 (locking strategies):	degree of concurrency of queries and updates

Miscellaneous

990 (additional features):	

Volume Contents

NUMBER 1

Israel Gold and **Haran Boral**	1	The power of the private workspace model
Sol. J. Greenspan, Alexander Borgida and **John Mylopoulos**	9	A requirements modeling language and its logic
S. Ceri, G. Gottlob and **G. Pelagatti**	25	Taxonomy and formal properties of distributed joins
Isamu Kobayashi	41	Losslessness and semantic correctness of database schema transformation: another look of schema equivalence
José Fiadeiro and **Amílcar Sernadas**	61	The INFOLOG linear tense propositional logic of events and transactions
G. Barbara Demo and **Sukhamay Kundu**	87	Modeling the CODASYL DML context dependency for database program conversion
	101	Reports and theses
	107	News Section
	108	Software Survey Section PDS PRESSDATABANK

NUMBER 2

Isamu Kobayashi	109	Classification and transformations of binary relationship relation schemata
Levent Orman	123	Functional data model design
H.-J. Schek and **M. H. Scholl**	137	The relational model with relation-valued attributes
Sonia Berman	149	A semantic data model as the basis for an automated database design tool
S. D. Lang, J. R. Driscoll and **J. H. Jou**	167	Batch insertion for tree structured file organizations—Improving differential database representation
M. A. Bassiouni and **B. Ok**	177	Double encoding—A technique for reducing storage requirement of text
Juhani Iivari	185	Dimensions of information systems design: A framework for a long-range research program
	I	Software Survey Section

NUMBER 3

S. Bergamaschi and **M. R. Scalas**	199	Choice of the optimal number of blocks for data access by an index
Francesco M. Malvestuto	211	Statistical treatment of the information content of a database
Levent Orman	225	Redundancy in functional databases
Betty Salzberg	235	Grid file concurrency
Michael Z. Hanani and **Peretz Shoval**	245	A combined methodology for information systems analysis and design based on ISAC and NIAM
Arun Sen and **Chee Ching**	255	Schema translation: A three-level semantic abstraction approach
	271	Reports and Theses
	I	News Section
	III	Software Survey Section

NUMBER 4

Erhard Rahm	275	Primary copy synchronization for DB-Sharing
Virgil Gligor and **Radu Popescu-Zeletin**	287	Transaction management in distributed heterogeneous database management systems
Erkki Lehtinen and **Kalle Lyytinen**	299	Action based model of information system
M. Y. Chan and **F. C. P. Chan**	319	Database concurrency control using read/write set information
P. Pistor and **R. Traunmueller**	323	A database language for sets, lists and tables
K. D. Sharma and **Rekha Jain**	337	Choosing an optimal sequence of discriminators
Abdullah Uz Tansel	343	Adding time dimension to relational model and extending relational algebra
	357	Reports and Theses
	I	News Section
	V	Software Survey Section